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LensCLEANing JVAS B0218+357 to determine H_0

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Abstract. We use the radio ring in JVAS B0218+357 to constrain the mass models with LensCLEAN. H_0 is determined from the resulting model and the time delay. B0218+357 is one of the best systems to reduce systematic errors in H_0 and may thus be called a "golden lens".

1. Introduction

Gravitational lensing offers the unique possibility to determine the Hubble constant H_0 (Refsdal 1964) involving the understanding of very little astrophysics, keeping statistical and systematic errors well under control. The main uncertainty is introduced by the mass models of the lens. For multiply imaged compact sources, the number of constraints is very small. To overcome this difficulty, lensed extended sources can be used.

2. The 18 karat golden lens JVAS B0218+357

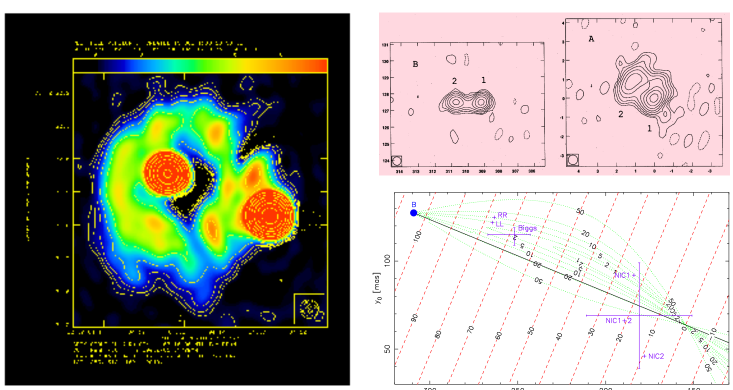

Figure 1. a) 5 GHz MERLIN/VLA map of the ring (Biggs et al. 2001) b) 15 GHz VLBI maps of A and B (Patnaik, Porcas, and Browne 1995). c) Contours of H_0 (straight lines) and χ^2 residuals (dotted; without using the ring data) as a function of the lens position

Many constraints for the lens models are available from observations: small scale substructure of the compact images on a scale of milliarcseconds (constrains the radial mass profile, which is close to isothermal) and a highly structured

Einstein ring. The lens is an isolated non-interacting galaxy; lens models can thus be kept simple (Lehár et al. 2000). The only disadvantage is the very small size of the system ($0\overset{\prime\prime}{.}33$). A direct measurement of the lens centre's position has not been achieved yet, but will soon be possible (HST-ACS observations in cycle 11, PI: Neal Jackson).

3. LensCLEAN

We used an improved version of the LensCLEAN algorithm (Kochanek & Narayan 1992; Ellithorpe, Kochanek, & Hewitt 1996) to constrain the position of the lens centre, which is the most important model parameter. LensCLEAN works by deconvolving radio interferometer data under the constraint of a given lens model. The residuals are then used to find the best fitting lens model.

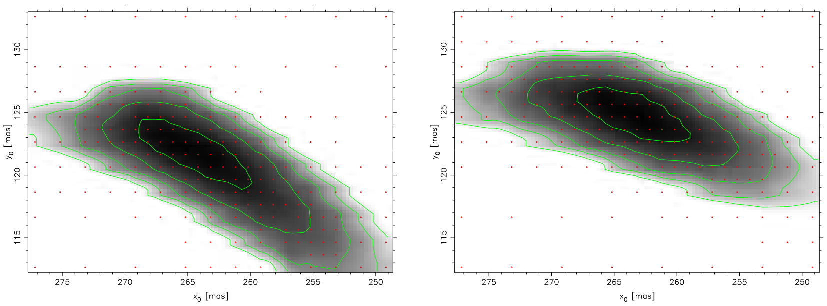

Figure 2. LensCLEAN residuals (VLA 15 GHz) as a function of the lens position (LL and RR polarization)

The accuracy is of the order a few mas, or a few per cent in H_0. The result for singular isothermal ellipsoidal models, using the time delay $\Delta t = (10.5 \pm 0.4)$ days from Biggs et al. (1999) is

$$H_0 = 77\,\mathrm{km\,s^{-1}\,Mpc^{-1}} \quad .$$

Details will be published in an upcoming paper (Wucknitz et al., in prep.). The original full-length poster version is available from the author or on the web (`http://www.hs.uni-hamburg.de/EN/Ins/Per/Wucknitz`).

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